

07-19-00

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Practitioner's Docket No. 49732-DIV (1117)

PATENT

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Patent Application  
 Assistant Commissioner for Patents  
 Washington, D.C. 20231

## NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of

Inventor(s): Yuji SAWADA, Yasuhisa NAKAMURA, Hisashi SAIGA, Masafumi YAMANOUE,  
 Keisuke IWASAKI, and Yoshihiro KITAMURA

WARNING: 37 CFR 1.41(a)(1) points out:

"(a) A patent is applied for in the name or names of the actual inventor or inventors.

(1) The inventorship of a nonprovisional application is that inventorship set forth in the oath or declaration as prescribed by § 1.63, except as provided for in § 1.53(d)(4) and § 1.63(d). If an oath or declaration as prescribed by § 1.63 is not filed during the pendency of a nonprovisional application, the inventorship is that inventorship set forth in the application papers filed pursuant to § 1.53(b), unless a petition under this paragraph accompanied by the fee set forth in § 1.17(i) is filed supplying or changing the name or names of the inventor or inventors."

For (title): **DISPLAY CONTROL DEVICE AND REPRODUCTION DISPLAY DEVICE FOR ELECTRONIC BOOKS**

## CERTIFICATION UNDER 37 C.F.R. 1.10\*

(Express Mail label number is **mandatory**.)

(Express Mail certification is optional.)

I hereby certify that this correspondence and the documents referred to as attached therein are being deposited with the United States Postal Service on this date July 17, 2000, in an envelope as "Express Mail Post Office to Addressee," mailing Label Number EL180585624US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Susan M. Dillon

(type or print name of person mailing paper)

Susan M Dillon

Signature of person mailing paper

WARNING: Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.

\*WARNING: Each paper or fee filed by "Express Mail" **must** have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. 1.10(b).  
 "Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will **not** be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.

## 1. Type of Application

This new application is for a(n)

*(check one applicable item below)*

☒ Original (nonprovisional)

☐ Design

☐ Plant

**WARNING:** *Do not use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. 371(c)(4), unless the International Application is being filed as a divisional, continuation or continuation-in-part application.*

**WARNING:** *Do not use this transmittal for the filing of a provisional application.*

**NOTE:** *If one of the following 3 items apply, then complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED and a NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION.*

☒ Divisional.

☐ Continuation.

☐ Continuation-in-part (C-I-P).

## 2. Benefit of Prior U.S. Application(s) (35 U.S.C. 119(e), 120, or 121)

**NOTE:** *A nonprovisional application may claim an invention disclosed in one or more prior filed copending nonprovisional applications or copending international applications designating the United States of America. In order for a nonprovisional application to claim the benefit of a prior filed copending nonprovisional application or copending international application designating the United States of America, each prior application must name as an inventor at least one inventor named in the later filed nonprovisional application and disclose the named inventor's invention claimed in at least one claim of the later filed nonprovisional application in the manner provided by the first paragraph of 35 U.S.C. 112. Each prior application must also be:*

*(i) An international application entitled to a filing date in accordance with PCT Article 11 and designating the United States of America; or*

*(ii) Complete as set forth in § 1.51(b); or*

*(iii) Entitled to a filing date as set forth in § 1.53(b) or § 1.53(d) and include the basic filing fee set forth in § 1.16; or*

*(iv) Entitled to a filing date as set forth in § 1.53(b) and have paid therein the processing and retention fee set forth in § 1.21(l) within the time period set forth in § 1.53(f).*

37 CFR 1.78(a)(1).

**NOTE** *If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., or benefit of a prior provisional*

application is claimed, then check the following item and complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

**WARNING:** If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. 120, 121 or 365(c). (35 U.S.C. 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. 119, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.

**WARNING:** When the last day of pendency of a provisional application falls on a Saturday, Sunday, or Federal holiday within the District of Columbia, any nonprovisional application claiming benefit of the provisional application **must** be filed prior to the Saturday, Sunday, or Federal holiday within the District of Columbia. See 37 C.F.R. § 1.78(a)(3).

☒ [X] The new application being transmitted claims the benefit of prior U.S. application(s).  
Enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE  
BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

### 3. Papers Enclosed

#### A. Required for Filing Date under 37 C.F.R. 1.53(b) (Regular) or 37 C.F.R. 1.153 (Design) Application

61 Pages of Specification  
5 Pages of Claims  
31 Sheets of Drawing

☒ [X] Formal  
☐ [ ] Informal

#### B. Other Papers Enclosed

1 Pages of Abstract  
\_\_\_\_\_ Other

**WARNING:** **DO NOT** submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted to the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to § 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted to the Office. Only one copy is required or desired. For comments on proposed then-new 37 C.F.R. 1.84, see Notice of March 9, 1988 . . . (1990 O.G. 57-62).

**NOTE:** "Identifying indicia, if provided, should include the application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application. This information should be placed on the back of each sheet of drawing a minimum distance of 1.5 cm. (5/8 inch) down from the top of the page." 37 C.F.R. 1.84(c)).

(complete the following, if applicable)

- ☐ The enclosed drawing(s) are photograph(s), and there is also attached a "PETITION TO ACCEPT PHOTOGRAPH(S) AS DRAWING(S)." 37 C.F.R. 1.84(b).

**4. Additional Papers Enclosed**

- ☒ Preliminary Amendment  
☒ Information Disclosure Statement (37 C.F.R. 1.98)  
☒ Form PTO-1449  
☒ Citations  
☐ Declaration of Biological Deposit  
☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.  
☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative  
☐ Special Comments  
☐ Other:

**5. Declaration or Oath**

*NOTE: A newly executed declaration is not required in a continuation or divisional application provided the prior nonprovisional application contained a declaration as required, the application being filed is by all or fewer than all the inventors named in the prior application, there is no new matter in the application being filed, and a copy of the executed declaration filed in the prior application (showing the signature or an indication thereon that it was signed) is submitted. The copy must be accompanied by a statement requesting deletion of the names of person(s) who are not inventors of the application being filed. If the declaration in the prior application was filed under § 1.47 then a copy of that declaration must be filed accompanied by a copy of the decision granting § 1.47 status or, if a nonsigning person under § 1.47 has subsequently joined in a prior application, then a copy of the subsequently executed declaration must be filed. See 37 CFR 1.63(d).*

*NOTE: A declaration filed to complete an application must be executed, identify the specification to which it is directed, identify each inventor by full name, including the family name, and at least one given name without abbreviation together with any other given name or initial, and the residence, post office address and country of citizenship of each inventor and state whether the inventor is a sole or joint inventor. 37 CFR 1.63(a)(1)-(4).*

- ☒ Enclosed (copy as filed in parent application)

Executed by

(check all applicable boxes)

- ☒ inventor(s).  
☐ legal representative of inventor(s). 37 CFR 1.42 or 1.43.  
☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.  
☐ This is the petition required by 37 CFR 1.47 and the statement required by 37 CFR 1.47 is also attached. See item 13 below for fee.  
☐ Not Enclosed.

*NOTE: Where the filing is a completion in the U.S. of an International Application, or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.*

- ☐ Application is made by a person authorized under 37 C.F.R. 1.41(c) on behalf of all the above named inventor(s).

*(The declaration or oath, along with the surcharge required by 37 CFR 1.16(e), can be filed subsequently).*

NOTE: It is important that all the correct inventor(s) are named for filing under 37 CFR 1.41(c) and 1.53(b).

- ☐ Showing that the filing is authorized.  
*(not required unless called into question. 37 CFR 1.41(d))*

## 6. Inventorship Statement

**WARNING:** *If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.*

The inventorship for all the claims in this application are:

- ☐ The same.

or

☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,

- ☐ is submitted.  
☐ will be submitted.

## 7. Language

NOTE: *An application including a signed oath or declaration may be filed in a language other than English. An English translation of the non-English language application and the processing fee of \$130.00 required by 37 CFR 1.17(k) is required to be filed with the application, or within such time as may be set by the Office. 37 CFR 1.52(d).*

- ☒ English  
☐ Non-English

- ☐ The attached translation includes a statement that the translation is accurate. 37 C.F.R. 1.52(d).

## 8. Assignment

☒ An assignment of the invention to Sharp Kabushiki Kaisha, Osaka, Japan

- ☐ is attached. A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.  
☒ was filed in the parent application  
☐ will follow.

NOTE: "If an assignment is submitted with a new application, send two separate letters-one for the application and one for the assignment" Notice of May 4, 1990 (1114 O.G. 77-78).

**WARNING:** A newly executed "STATEMENT UNDER 37 CFR 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 1993, 1150 O.G. 62-64.

**9. Certified Copy**

Certified copy(ies) of application(s)

**Country** \_\_\_\_\_ **Appln. No.** \_\_\_\_\_ **Filed** \_\_\_\_\_

from which priority is claimed

- ☐ is enclosed.  
☐ was filed.  
☐ will follow.

NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 CFR 1.55(a) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. 120 is itself entitled to priority from a prior foreign application, then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

**10. Fee Calculation (37 C.F.R. 1.16)**

A. ☒ Regular application

**CLAIMS AS FILED**

Claims	Number Filed	Basic Fee Allowance	Number Extra	Rate	Basic Fee 37 C.F.R. 1.16(a) \$690.00
<b>Total Claims (37 CFR 1.16(c))</b>	11	- 20 =	0	x \$ 18.00	
<b>Independent Claims (37 CFR 1.16(b))</b>	1	- 3 =	0	x \$78.00	
<b>Multiple Dependent Claim(s), if any (37 CFR 1.16(d))</b>			+	\$260.00	

- ☐ Amendment cancelling extra claims is enclosed.  
☐ Amendment deleting multiple-dependencies is enclosed.  
☐ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing they must be paid or the claims cancelled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 CFR 1.16(d).

Filing Fee Calculation \$ 690.00

B. ☐ Design application  
(\$330.00—37 CFR 1.16(f))

Filing Fee Calculation \$

C. ☐ Plant application  
(\$540.00—37 CFR 1.16(g))

Filing Fee Calculation \$

# 11. Small Entity Statement(s)

☐ Statement(s) that this is a filing by a small entity under 37 CFR 1.9 and 1.27 is (are) attached.

## WARNING:

*"Status as a small entity must be specifically established in each application or patent in which the status is available and desired. Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. The refiling of an application under § 1.53 as a continuation, division, or continuation-in-part (including a continued prosecution application under § 1.53(d)), or the filing of a reissue application requires a new determination as to continued entitlement to small entity status for the continuing or reissue application. A nonprovisional application claiming benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) of a prior application, or a reissue application may rely on a statement filed in the prior application or in the patent if the nonprovisional application or the reissue application includes a reference to the statement in the prior application or in the patent or includes a copy of the statement in the prior application or in the patent and status as a small entity is still proper and desired. The payment of the small entity basic statutory filing fee will be treated as such a reference for purposes of this section." 37 CFR 1.28(a)(2).*

(complete the following, if applicable)

☐ Status as a small entity was claimed in prior application \_\_\_\_\_, filed on \_\_\_\_\_ from which benefit is being claimed for this application under:

35 U.S.C. § ☐ 119(e),  
☐ 120,  
☐ 121,  
☐ 365(c),

and which status as a small entity is still proper and desired.

☐ A copy of the statement in the prior application is included.

Filing Fee Calculation (50% of A, B or C above) \$

NOTE: Any excess of the full fee paid will be refunded if a small entity status is established refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendable under § 1.136. 37 CFR 1.28(a).

12. Request for International-Type Search (37 C.F.R. 1.104(d))

(complete, if applicable)

- ☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

13. Fee Payment Being Made at This Time

- ☐ Not Enclosed

- ☐ No filing fee is to be paid at this time.  
(This and the surcharge required by 37 C.F.R. 1.16(e) can be paid subsequently.)

- ☒ Enclosed

- ☒ Filing fee \$ 690.00

- ☐ Recording assignment  
(\$40.00; 37 C.F.R. 1.21(h))  
(See attached "COVER SHEET FOR  
ASSIGNMENT ACCOMPANYING NEW  
APPLICATION.") \$

- ☐ Petition fee for filing by other than  
all the inventors or person on behalf  
of the inventor where inventor  
refused to sign or cannot be reached  
(\$130.00; 37 C.F.R. 1.47 and 1.17(i)) \$

- ☐ For processing an application with a  
specification in a non-English language  
(\$130.00; 37 C.F.R. 1.52(d) and 1.17(k)) \$

- ☐ Processing and retention fee  
(\$130.00; 37 C.F.R. 1.53(d) and 1.21(l)) \$

- ☐ Fee for international-type search report  
(\$40.00; 37 C.F.R. 1.21(e)) \$

NOTE: 37 CFR 1.21(l) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 CFR 1.53(f) and this, as well as the changes to 37 CFR 1.53 and 1.78(a)(1), indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of § 1.21(l) must be paid, within 1 year from notification under § 53(f).

Total Fees Enclosed \$ 690.00



**14. Method of Payment of Fees**

- ☒ Check in the amount of \$ 690.00
- ☐ Charge Account No. \_\_\_\_\_ in the amount of \$ \_\_\_\_\_.  
A duplicate of this transmittal is attached.

*NOTE: Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37 CFR 1.22(b).*

**15. Authorization to Charge Additional Fees**

**WARNING:** *If no fees are to be paid on filing, the following items should not be completed.*

**WARNING:** *Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.*

- ☒ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No. 04-1105
- ☒ 37 C.F.R. 1.16(a), (f) or (g) (filing fees)
- ☒ 37 C.F.R. 1.16(b), (c) and (d) (presentation of extra claims)

*NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 CFR 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.*

- ☒ 37 C.F.R. 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)
- ☐ 37 CFR 1.17(a)(1)-(5) (extension fees pursuant to § 1.136(a).
- ☐ 37 C.F.R. 1.17 (application processing fees)

*NOTE: "A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 CFR 1.136(a)(3).*

- ☐ 37 C.F.R. 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. 1.311(b))

*NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 CFR 1.311(b)).*

*NOTE: 37 CFR 1.28(b) requires "Notification of any change in status resulting in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying, . . . issue fee." From the wording of 37 CFR 1.28(b), (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.*

**16. Instructions as to Overpayment**

NOTE: "... Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 CFR 1.26(a).

☒ Credit Account No. 04-1105

☐ Refund

Christine C. O'Day  
**SIGNATURE OF PRACTITIONER**

Reg. No. 38,256

Christine C. O'Day  
(type or print name of practitioner)

Tel. No.: (617) 523-3400

Dike, Bronstein, Roberts & Cushman  
Intellectual Property Group  
Edwards & Angell, LLP  
130 Water Street  
P.O. Address

Customer No.:

Boston, MA 02109

☒ **Incorporation by reference of added pages**

*(check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED)*

☒ Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added 5

☒ Plus Added Pages for Papers Referred to in Item 4 Above

Number of pages added 9

☐ Plus added pages deleting names of inventor(s) named on prior application(s) who is/are no longer inventor(s) of the subject matter claimed in this application.

Number of pages added \_\_\_\_\_

☐ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added \_\_\_\_\_

☐ **Statement Where No Further Pages Added**

*(if no further pages form a part of this Transmittal, then end this Transmittal with this page and check the following item)*

☐ This transmittal ends with this page.

# **ADDED PAGES FOR APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED**

NOTE: See 37 CFR 1.78.

## **17. Relate Back**

**WARNING:** If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. 120, 121 or 365(c). (35 U.S.C. 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. 119, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.

(complete the following, if applicable)

☒ Amend the specification by inserting, before the first line, the following sentence:

### **A. 35 U.S.C. 119(e)**

NOTE: "Any nonprovisional application claiming the benefit of one or more prior filed copending provisional applications must contain or be amended to contain in the first sentence of the specification following the title a reference to each such prior provisional application, identifying it as a provisional application, and including the provisional application number (consisting of series code and serial number)." 37 C.F.R. § 1.78(a)(4).

☐ "This application claims the benefit of U.S. Provisional Application(s) No(s).:

**APPLICATION NO(S).:**

**FILING DATE**

_____	_____
_____	_____
_____/_____	_____

### **B. 35 U.S.C. 120, 121 and 365(c)**

NOTE: "Except for a continued prosecution application filed under § 1.53(d), any nonprovisional application claiming the benefit of one or more prior filed copending nonprovisional applications or international applications designating the United States of America must contain or be amended to contain in the first sentence of the specification following the title a reference to each such prior application, identifying it by application number (consisting of the series code and serial number) or international application number and international filing date and indicating the relationship of the applications. . . . Cross-references to other related applications may be made when appropriate." (See § 1.14(a)). 37 C.F.R. § 1.78(a)(2).

☒ "This application is a

☐ continuation

☐ continuation-in-part

☒ divisional

of copending application(s)

☒ application number 09/530,393, filed on April 28, 2000, which is a continuation of International Application No. PCT/JP98/04324, filed on September 25, 1998 “

☐ International Application \_\_\_\_\_ filed on \_\_\_\_\_ and which designated the U.S.”

NOTE: *The proper reference to a prior filed PCT application that entered the U.S. national phase is the U.S. serial number and the filing date of the PCT application that designated the U.S.*

NOTE: *(1) Where the application being transmitted adds subject matter to the International Application, then the filing can be as a continuation-in-part or (2) if it is desired to do so for other reasons then the filing can be as a continuation.*

NOTE: *The deadline for entering the national phase in the U.S. for an international application was clarified in the Notice of April 28, 1987 (1079 O.G. 32 to 46) as follows:*

*“The Patent and Trademark Office considers the International application to be pending until the 22nd month from the priority date if the United States has been designated and no Demand for International Preliminary Examination has been filed prior to the expiration of the 19th month from the priority date and until the 32nd month from the priority date if a Demand for International Preliminary Examination which elected the United States of America has been filed prior to the expiration of the 19th month from the priority date, provided that a copy of the international application has been communicated to the Patent and Trademark Office within the 20 or 30 month period respectively. If a copy of the international application has not been communicated to the Patent and Trademark Office within the 20 or 30 month period respectively, the international application becomes abandoned as to the United States 20 or 30 months from the priority date respectively. These periods have been placed in the rules as paragraph (h) of § 1.494 and paragraph (i) of § 1.495. A continuing application under 35 U.S.C. 365(c) and 120 may be filed anytime during the pendency of the international application.”*

☐ “The nonprovisional application designated above, namely application \_\_\_\_\_ / \_\_\_\_\_, filed \_\_\_\_\_, claims the benefit of U.S. Provisional Application(s) No(s).:

**APPLICATION NO(S).:**

**FILING DATE**

_____ / _____	_____”
_____ / _____	_____”
_____ / _____	_____”

☐ Where more than one reference is made above please combine all references into one sentence.

## 18. Relate Back—35 U.S.C. 119 Priority Claim for Prior Application

The prior U.S. application(s), including any prior International Application designating the U.S., identified above in item 17B, in turn itself claim(s) foreign priority(ies) as follows:

Country	Appln. no.	Filed
Japan	9-296601	October 29, 1997
Japan	10-85405	March 31, 1998

The certified copy(ies) has (have)

☒ [X] been filed on \_\_\_\_\_, in prior application PCT/JP98/04324, which was filed on September 25, 1998.

☐ [ ] is (are) attached.

**WARNING:** *The certified copy of the priority application that may have been communicated to the PTO by the International Bureau may not be relied on without any need to file a certified copy of the priority application in the continuing application. This is so because the certified copy of the priority application communicated by the International Bureau is placed in a folder and is not assigned a U.S. serial number unless the national stage is entered. Such folders are disposed of if the national stage is not entered. Therefore, such certified copies may not be available if needed later in the prosecution of a continuing application. An alternative would be to physically remove the priority documents from the folders and transfer them to the continuing application. The resources required to request transfer, retrieve the folders, make suitable record notations, transfer the certified copies, enter and make a record of such copies in the Continuing Application are substantial. Accordingly, the priority documents in folders of international applications that have not entered the national stage may not be relied on. Notice of April 28, 1987 (1079 O.G. 32 to 46).*

## 19. Maintenance of Copendency of Prior Application

**NOTE:** *The PTO finds it useful if a copy of the petition filed in the prior application extending the term for response is filed with the papers constituting the filing of the continuation application. Notice of November 5, 1985 (1060 O.G. 27).*

A. ☐ [ ] Extension of time in prior application

*(This item **must** be completed and the papers filed in the prior application, if the period set in the prior application has run.)*

☐ [ ] A petition, fee and response extends the term in the pending **prior** application until \_\_\_\_\_

☐ [ ] A **copy** of the petition filed in prior application is attached.

B. ☐ [ ] Conditional Petition for Extension of Time in Prior Application

*(complete this item, if previous item not applicable)*

☐ [ ] A conditional petition for extension of time is being filed in the pending **prior** application.

☐ A copy of the conditional petition filed in the prior application is attached.

**20. Further Inventorship Statement Where Benefit of Prior Application(s) Claimed**

*(complete applicable item (a), (b) and/or (c) below)*

(a) ☐ This application discloses and claims only subject matter disclosed in the prior application whose particulars are set out above and the inventor(s) in this application are

☐ the same.

☐ less than those named in the prior application. It is requested that the following inventor(s) identified for the prior application be deleted:

---

*(type name(s) of inventor(s) to be deleted)*

(b) ☐ This application discloses and claims additional disclosure by amendment and a new declaration or oath is being filed. With respect to the prior application, the inventor(s) in this application are

☐ the same.

☐ the following additional inventor(s) have been added:

---

*(type name(s) of inventor(s) to be deleted)*

(c) ☐ The inventorship for all the claims in this application are

☐ the same.

☐ not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made

☐ is submitted.

☐ will be submitted.

**21. Abandonment of Prior Application *(if applicable)***

☐ Please abandon the prior application at a time while the prior application is pending, or when the petition for extension of time or to revive in that application is granted, and when this application is granted a filing date, so as to make this application copending with said prior application.

*NOTE: According to the Notice of May 13, 1983 (103, TMOG 6-7), the filing of a continuation or continuation-in-part application is a proper response with respect to a petition for extension of time or a petition to revive and should include*

the express abandonment of the prior application conditioned upon the granting of the petition and the granting of a filing date to the continuing application.

## 22. Petition for Suspension of Prosecution for the Time Necessary to File an Amendment

**WARNING:** "The claims of a new application may be finally rejected in the first Office action in those situations where (1) the new application is a continuing application of, or a substitute for, an earlier application, and (2) all the claims of the new application (a) are drawn to the same invention claimed in the earlier application, and (b) would have been properly finally rejected on the grounds of art of record in the next Office action if they had been entered in the earlier application." MPEP, § 706.07(b).

**NOTE:** Where it is possible that the claims on file will give rise to a first action final for this continuation application and for some reason an amendment cannot be filed promptly (e.g., experimental data is being gathered) it may be desirable to file a petition for suspension of prosecution for the time necessary.

(check the next item, if applicable)

☐ There is provided herewith a Petition To Suspend Prosecution for the Time Necessary to File An Amendment (New Application Filed Concurrently)

## 23. Small Entity (37 CFR § 1.28(a))

☐ Applicant has established small entity status by the filing of a statement in parent application No. \_\_\_\_\_

☐ A copy of the statement previously filed is included.

**WARNING:** See 37 CFR § 1.28(a).

## 24. NOTIFICATION IN PARENT APPLICATION OF THIS FILING

☐ A notification of the filing of this  
(check one of the following)

- ☐ continuation
- ☐ continuation-in-part
- ☐ divisional

is being filed in the parent application, from which this application claims priority under 35 U.S.C. § 120.



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

APPLICANT: Yuji SAWADA, Yasuhisa NAKAMURA, Hisashi SAIGA,  
Masafumi YAMANOUE, Keisuke IWASAKI and  
Yoshihiro KITAMURA

SERIAL NO.: Not Yet Assigned  
(Divisional of U.S.S.N. 09/530,393, filed April 28, 2000  
[Express Mail Label No. EL180585624US])

FILED: Herewith

FOR: DISPLAY CONTROL DEVICE AND REPRODUCTION DISPLAY  
DEVICE FOR ELECTRONIC BOOKS

Honorable Commissioner of Patents and Trademarks  
Washington, D.C. 20231

Sir:

**PRELIMINARY AMENDMENT**

Applicants kindly ask that the above-identified application be amended as follows:

**IN THE CLAIMS:**

Kindly add the following new claims.

--19. (new) A reproduction display device for reproducing and displaying element data prepared in units of reproduction, wherein data of each element data is divided into data for high-speed reproduction and remaining data and stored respectively and the data for high-speed reproduction is subsequently reproduced and displayed once a command for starting high-speed reproduction is given.

20. A reproduction display device as defined in claim 19, wherein in the element data, the data for high-speed reproduction is compressed differently from the remaining data.

21. A reproduction display device as defined in claim 19, wherein the element data is color image data and the data for high-speed reproduction is a plane image composed of monochromatic components and the remaining data is a plane image composed of other components.

22. A reproduction display device as defined in claim 19, wherein the element data is image data and the data for high-speed reproduction is a significant bit image produced by a part of bits of each pixel and the remaining data is an insignificant bit image produced by bits other than that of the significant bit image.

23. A reproduction display device as defined in claim 19, wherein the element data is image data and the data for high-speed reproduction is a significant bit-plane image related to several significant bits of bit-plane images produced by each bit of each pixel and the remaining data is remaining bit-plane images of the significant bit-plane image.

24. A reproduction display device as defined in claim 19, wherein the element data is image data and the data for high-speed reproduction is a thinned image produced by omitting a certain number of pixels therefrom and the remaining data is remaining pixels other than that of the thinned image.

25. A reproduction display device as defined in claim 19, wherein the element data is video data and the data for high-speed reproduction is at least one representative frame image selected from the video data and the remaining data is frame images other than the representative frame image.

26. A reproduction display device as defined in claim 23, wherein a number of significant bits of the significant bit-plane image composing the data for high-speed reproduction is changeable by a user's designation.

27. A reproduction display device as defined in claim 24, wherein a magnification ratio of the thinned image for high-speed reproduction is changeable by user's designation when receiving and displaying the thinned image reproduced at a high-speed in enlargement.

28. A reproduction display device as defined in claim 25, wherein a number of representative frames being the data for high-speed reproduction is changeable by user's designation.

29. A reproduction display device as defined in claim 19, wherein it is further provided with a condition setting means for setting at least one of a data classification of the element data, data size of the element data and position information of the element data in a unit to be reproduced and the element data to be reproduced at a high-speed is decided based on conditions set by the condition setting means.--

Please cancel claims 1-18 without prejudice.

#### **REMARKS**

Claims 1-18 have been cancelled without prejudice and claims 19-29 have been added. No new matter is presented by virtue of this Amendment.

Applicants respectfully request entry of this Amendment prior to examination.

Early consideration and allowance of the application are earnestly solicited.

Yuji SAWADA, Yasuhisa NAKAMURA, Hisashi SAIGA, Masafumi YAMANOUE, Keisuke IWASAKI and Yoshihiro KITAMURA

Page 4

# DISPLAY CONTROL DEVICE AND REPRODUCTION DISPLAY DEVICE FOR ELECTRONIC BOOKS

## TECHNICAL FIELD

The present invention relates to an electronic book device by which a user can read an electronic document as if he or she was reading a printed book and, more specifically, relates to an electronic book display control device capable of reproducing electronic image data of a document, and a data structure and a reproduction display device capable of changing the display image contents at a high speed.

## BACKGROUND OF THE INVENTION

Prior arts relating to electronic book display control methods for changing display scenes just like turning pages of a printed book are disclosed in Japanese Laid-Open Patent Publication No.64-86191 and 2-181864. The former provides an electronic book device that has a control portion including a memory for storing two kinds of images, two selectors and a speed controller and can changeover a display image just as it turns a page of the book by presenting a next image on a part of a display area of a preceding image and by gradually increasing the next image and finally displaying a full image on a full screen. The latter provides a user-friendly electronic book device that has a book-contour display portion to display a contour image of the book and open the book when

the user points a position on a fore-edge of the book and giving the user a feeling of reading the book by changing the thickness of the fore-edge of the book displayed on the display portion.

Japanese Laid-Open Patent Publication No.5-53726 describes a display tablet device that detects a trace, a direction and a speed of movement of a pen on a display screen by an input detector.

With a display device for displaying a plurality of data-recorded sheets such as data of plural document pages and image data of a image filing device, one may often change in succession display images to search objective data. In this instance, if display data is fully displayed every time, high-speed changeover of data images cannot be realized and the retrieving efficiency is decreased. In view of the above, an image filing device disclosed in Japanese Laid-Open Patent Publication No.1-269174 performs the retrieval of objective data in a data image memory in such a manner that a part area of data being displayed on the screen is designated first by the user, the data is then retrieved from the specified data area in the image data memory and displayed by repeating the above cycle of retrieval operations to find the objective data. Japanese Laid-Open Patent Publication No.4-120670 also discloses such a method that original image data and contracted data of the original image are stored in a memory device, contracted data is read in retrieving and displayed in succession like turning pages at a high speed.

However, methods disclosed in Japanese Laid-Open Patent Publications No.64-86191 and No. 2-181864 have such drawbacks that the display is controlled according to the data calculated by the speed controller and hence it is difficult to flexibly change the speed of display in accordance with the type and contents of data stored in a memory. For example, it is impossible to change a display image just as turning of a page of the book in spread state. The both systems have the limit to its display control and cannot realize, in this sense, a display that is so called friendly to users.

The above systems can turn pages at a specified display speed calculated by its controller and hence cannot control the display speed in accordance with the contents of data to be displayed or skip a page.

The system disclosed in Japanese Laid-Open Patent Publication No.5-53726 involves such a problem that it requires, besides display memory, the provision of an additional image-memory whose capacity is two times larger than the display area.

The system disclosed in Japanese Laid-Open Patent Publication No. 1-269174 has no consideration of a method for storing display data necessary for changing page images at a high speed and hence requires time for turning pages.

The system disclosed in Japanese Laid-Open Patent Publication No. 4-120670 has to store a large number of data because the contracted images preliminarily registered

include redundant data.

Furthermore, the above systems cannot be adapted to turning pages of a recent available document whose pages may include various kinds of data such as characters, pictures, audio signals and moving pictures on one page.

To solve the above problems involved in the prior arts, the present invention is intended to provide a display changeover control portion including a table for storing column information necessary for turning pages and means for selecting addresses of a display preparation image data storage portion and image data of a current display page and a next display page from the column information, which can control the display speed flexibly in accordance with image data to be displayed, realizing changeover of display images just as turning pages of a printed book.

To solve the problem involved in the prior arts, the present invention also aims at saving of an image data memory capacity to a half the memory capacity of the prior art devices by providing a data latch for reading image data from the display image data storage portion and temporally storing it.

Another object of the present invention is to realize high-speed turning of pages by storing information of a display image sequence in a high-speed read-only memory.

A further object of the present invention is to provide a data structure and a reproduction display device that can perform high-speed changeover of display images.



## SUMMARY OF THE INVENTION

An electronic book display control device according to the present invention comprises a central processing unit (CPU) for controlling the whole device, an image data storage portion for storing therein the contents of the book as image data, an image data control portion for receiving the image data and performing required control, a display preparation image data storage portion for storing image data of a page being displayed and image data of a page to be displayed next, a display portion for displaying thereon information concerning the image data and information concerning the operation of the electronic book, a page-turning data storage portion for storing data displayed on the display portion at a specified time for a page-turning period, a column information storage table for storing column information of the page turning data, and a display changeover control portion including a selecting means for selecting an address of the display preparation image data storage portion and image data on the page being displayed and the to be displayed next according the column information. This device can therefore turn pages (display image) just as turning a printed book by flexibly controlling a current image and a next image according to the column information.

An electronic book display control device according to the present invention is also featured by storing the column information table in the image data storage portion and can

thereby realize turning of pages in accordance with the contents of the book.

An electronic book display control device according to the present invention is further featured by storing the column information table in a ROM or a rewritable ROM other than the image data storage portion and can thereby realize high-speed and flexible turning of pages.

An electronic book display control device according to the present invention is further featured by pairing the column information table with image data and can easily control image data on the page-by-page basis, thus realizing natural turning of pages of the image data like book.

An electronic book display control device according to the present invention is further featured by reading the column information into a column information storage table based on information observable on an input portion and can thereby display pages of the image data in accordance with the characteristics of the user and the story of the book.

An electronic book display control device according to the present invention comprises a central processing unit (CPU) for controlling the whole device, an image data storage portion for storing therein the contents of the book as image data, an image data control portion for receiving the image data and performing required control, a display preparation image data storage portion for storing image data of a page being displayed and image data of a page to be displayed next, a display portion

for displaying thereon information concerning the image data and information concerning the operation of the electronic book, a page-turning data storage portion for storing data displayed on the display portion at a specified time for a page-turning period, a column information storage table for storing column information of the page turning data, a display changeover control portion including a selecting means for selecting an address of the display preparation image data storage portion and image data on a page being displayed and a page to be displayed next according the column information, and a data latch for reading a part of the image data from the display image data storage portion and temporally storing the data therein. This device can therefore realize saving of the capacity of memory for display preparation image.

An electronic book display control device according to the present invention is also featured by storing a difference between data of the page being displayed and data of the page having been displayed just before the current page in the column information storage table, thus realizing further saving of the capacity of memory for display image.

An electronic book display control device according to the present invention is further featured by the providing an input selector and an output selector for selecting a memory at input and output portions of the display preparation image data storage, thereby realizing high-speed display of an image.

An electronic book display control device according to the

present invention is further featured by the fact that image data is divided and stored in the image data storage portion so as to be readable in the order necessary for turning pages, thus making it possible to preliminary read data to be displayed and thus achieving display of image data of a story with a saved memory capacity.

A reproduction display device according to the present invention is used for reproducing and displaying element data in units of reproduction of the device, wherein a partial data of the element data includes an identifier for high-speed reproduction and, when a request for a high-speed reproduction signal is given, the partial data is reproduced and displayed successively. This eliminates the necessity of preparing data specially designated for high-speed reproduction in units of reproduction, thereby realizing the reproduction in units of high speed reproduction by using a saved memory capacity. For electronic documents, a unit of data to be displayed is composed of data of each page image, so pages can be fast turned over on the display screen by using a reduced amount of data in a recording medium.

A reproduction display device according to the present invention is also featured by the fact that a partial data of the element (object) data for reproduction is differently compressed from the other data so that it can be reproduced at a further increased speed and achieve more high-speed turning pages than the electronic book. The element data is

preferable to be any of the following types:

Namely, the element data is image data, wherein a part of the data is a significant bit image produced by a part of bits of each pixel, a part of the data is a part of each divided bit-plane image, a part of the data is a thinned image produced by thinning pixels and a part of the data is divided image of an original image. The element data may also be video data, wherein a part of the data is a representative frame image selected from the video data.

A reproduction display device according to the present invention is featured by the fact that the element data is image data or video data and a ratio of the partial data to be displayed is changeably set, thereby making it possible for the user to reproduce and display the data at any desired speed even in a high-speed reproduction mode and to easily conduct retrieval of the display data.

A reproduction display device according to the present invention is featured by further provision of condition setting means for presetting at least one of conditions: data type (classification), data size of the element data and position information for a reproduction unit, wherein element data to be reproduced in the high-speed reproduction mode can be selected according to the preset conditions. This makes it possible for the user to omit the unnecessary or undesired data from the scope of reproduction, thus achieving an improved retrieving efficiency and an improved level of the display

operation control.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram of a whole device of an electronic book display control device according to a first embodiment of the present invention.

Figure 2 is illustrative of data for turning pages by the first embodiment of the present invention.

Figure 3 is a detailed view of a display changeover control portion of the first embodiment of the present invention.

Figure 4 is a flow chart illustrating the procedure according to the first embodiment of the present invention.

Figure 5 illustrates a method for invoking image data to be written into the memory for display preparation.

Figure 6 is a block diagram of a whole system of an electronic book display control device according to a second embodiment of the present invention.

Figure 7 is a detailed view of a display changeover control portion of the second embodiment of the present invention.

Figure 8 is a flow chart illustrating the procedure according to the second embodiment of the present invention.

Figure 9 is illustrative of data for turning pages by the second embodiment of the present invention.

Figure 10 is a block diagram of a whole system of an electronic book display control device according to a third embodiment of the present invention.

Figure 11 shows a transition state during turning pages.

Figure 12 schematically illustrates information representing a request for turning pages in input portion.

Figure 13 is a block diagram of electronic book display device according to the present invention.

Figure 14 is an external view of a portable type electronic book display device of Fig. 13.

Figure 15 is a schematic illustration of a format of book data to be reproduced by an electronic book display device according to the present invention.

Figure 16 is a detailed illustration of stored data in a book-data control-information area of Fig. 15.

Figure 17 is a mimic illustration of each page composed of plural objects arranged therein.

Figure 18 is a detailed illustration of stored data of each page of the book data of Fig. 15.

Figure 19 is a detailed illustration of stored data of object data corresponding to Fig. 18.

Figure 20 shows the correspondence between data-classification identifiers of object data corresponding to Fig. 18 and actual data.

Figure 21 illustrates a method for storing usual image data among object data.

Figure 22 depicts a method for decomposing image data into individual bit-plane images.

Figure 23 depicts a method for storing image data after

decomposing into individual bit-plane images among object data.

Figure 24 depicts a method for decomposing each of the image data pixels into significant bit images and insignificant bit images.

Figure 25 depicts a method for storing image data after decomposing into significant bit images and insignificant bit images of each of the image pixels among object data.

Figure 26 illustrates how to produce a thinned image by sampling pixels at intervals of the specified number of pixels

Figure 27 illustrates a method for storing image data after decomposing into thinned image and remaining pixel data among object data.

Figure 28 illustrates a method for storing usual video data among object data.

Figure 29 illustrates a method for storing video data in a representative frame area among object data.

Figure 30 illustrates how to decompose image data into plural block areas.

Figure 31 illustrates a method for storing image data after decomposing into plural block areas among object data.

Figure 32 is a flow chart illustrating a procedure of processing in a usual book-reading mode by an electronic book display device according to the present invention.

Figure 33 is a flow chart illustrating a procedure of processing in a high-speed page-turning mode by the electronic



book display device.

Figure 34 illustrates an exemplary screen image for setting reproduction conditions of an object in the high-speed page-turning mode.

Figure 35 is illustrative of an exemplary screen image for setting details of data classification in the high-speed page-turning mode.

Figure 36 is a flow chart illustrating a procedure for reading image data having a data-type identifier of 0x40 in the high-speed page-turning mode.

Figure 37 is a flow chart illustrating a procedure of reading image data stored after decomposing into individual bit planes in the high-speed page-turning mode.

Figure 38 is a flow chart illustrating a procedure of reading image data stored after decomposing into two bit image, i.e., a significant bit image and an insignificant bit image in a high-speed page-turning mode.

Figure 39 is a flow chart illustrating a procedure of reading image data stored after decomposing into (a thinned image and remaining pixel data) when operating in the high-speed page-turning mode.

Figure 40 is a flow chart illustrating a procedure of reading image data stored after decomposing blocks into plural areas in the high-speed page-turning mode.

Figure 41 is a flow chart illustrating a procedure of reading video data stored in a representative frame area in

the high-speed page-turning mode.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 1 is a block diagram of an electronic book display control device according to a first embodiment of the present invention.

As shown in Fig. 1, this electronic book display control device is composed of a central processing unit (CPU) 1 for controlling the whole device, an image data storage portion 2 for storing therein the contents of a book as image data, an image data control portion 3 for receiving the image data and performing required control, a display preparation image data storage portion 4 for storing image data of a page being displayed and image data of a next page to be displayed, a display portion 5 for displaying thereon information concerning the image data and information concerning the operation of the electronic book, a display control portion 6 for controlling the display portion, a display image data storage portion 7 for storing data to be displayed on the display portion, an input portion 8 for inputting data by the user to operate the device, a page-turning data storage portion 9 for storing data displayed on the display portion at a specified time for a page-turning period, a column information storage table 10 for storing column information of the page turning data and a display changeover control portion 11 including a selecting means for selecting an address of the

display preparation image data storage portion and image data on a page being displayed and a page to be displayed next according the column information. In the present invention, the page to be displayed next may be different from the next page of an actual book, i.e., it may be a next page or a preceding page or a page by several pages before or after the current page of the book if it is displayed next just after the page being displayed.

Figure 2 shows an example of page-turning data stored in the page-turning data storage portion. First, a vertical row  $T_0$ - $T_q$  is described. A suffix "q" designates the number of scenes (pages) to be turned over. Each  $T_0$ - $T_q$  represents a display time of each scene during turning of pages. Information on each display time is described by way example for four pages of a spread book. Let us assume that there is shown a book opened at spread pages 1 and 2 which page 2 is now turned to spread pages 3 and 4.

$T_0$  is a time of beginning of page-turning from the state of the book open at spread pages 1 and 2.  $T_2$  is an intermediate time of turning the page 2, whereat a half of the spread is the page 1 and the other remaining half consists of pages 2 and 4 being shown in a certain proportion to each other.  $T_q$  is a display time at which the page 2 is further turned to display the page 1 on one half and the page 4 on the other. Turning of page 2 is continued to a display time  $T_{p+2}$  at which a spread shows page 4 on one half and page 1 plus page 3 in a certain

proportion on the other half.  $T_q$  is a display time at which the page 2 is completely turned over to present the book opened at spread pages 3 and 4.

In Fig. 2, the horizontal row represents column numbers 0 to N in the display image data storage portion at corresponding points of time while turning pages. In each cell formed at a crossing of the vertical and horizontal rows, there is shown a letter A or B for representing a page being displayed or to be displayed next and a column number in the display preparation image data storage portion, which corresponds to a column number in the display image data storage portion. For example, the third cell from the left of the vertical time row  $T_2$  contains a code (B, 3) indicating that the data in the third row from the left in the display image data storage portion is read from the third row from the left of the display preparation image data memory in which a page to be displayed next is stored.

Figure 3 is a detailed block diagram of the display changeover control portion of Fig. 1, wherein numerals 14 and 15 designate two different memories in the display preparation image data storage portion, which memories are classified as memory "a" and memory "b" respectively. In Fig. 3, the components corresponding to those of Fig. 1 are given the same numerals. Numeral 21 denotes a counter for controlling scenes of turning pages. The counter 21 counts scenes from 0 and the number of count at the time of  $T_q$  is q. Numeral 22 designates

an address generator for repeatedly generating addresses of the display image data storage portion. Namely, it subsequently generates addresses from the left top to the right bottom in the display image data storage portion. Numeral 23 denotes a memory selecting portion for selecting any one of the memories of the display preparation image data storage portion referring to column information storage portion. Namely, it selects either the memory "a" or the memory "b".

The operation of the display changeover control portion will be described below in detail with reference to the flowchart of Fig. 4.

When a request for displaying a next page was input from the input portion, the CPU receives the request and transfers it to the image data control portion. According to the request, the image data control portion reads image data of a next page from the image data storage portion and writes the read-out image data of the next page into either memory "a" or "b", which is not occupied with image data of the page being displayed (Step S1). Namely, the image data of the page to be displayed next is stored in the memory "b" if the image data of the page being displayed is stored in the memory "a".

A time point of reading the image data corresponds to a time T0 of beginning turning of a page. Therefore, the display changeover control portion sets "0" at the counter (Step S2). At this time point T0, the address generator sets the leftmost top address (0, 0) as an address of the display image data and

initializes the address (Step S3).

The display changeover control portion sends the count value 0 and the abscissa value (x coordinate) 0 to the column information storage table (Step S4). The display changeover control portion acquires a corresponding memory of the display preparation image data storage portion and the abscissa value (x coordinate) from the column information storage table (Step S5). In this instance, the memory of the display preparation image data memory is A and the abscissa value (x coordinate) is 0 since the column is 0 and the time is T0.

The memory selector receives the above data and selects the memory of the display preparation image data storage portion and the display changeover control portion transfers the display preparation image data designated by the display preparation image data storage portion as the above to the display image data storage (Step S6). In Step S7, a routine judges whether the display image data has been completely displayed. When all the addresses of the display image data storage portion have been scanned according to the addresses produced by the address generator, the process advances to Step S9. Otherwise, the process advances to Step S8. The scanning is completed when all addresses from the leftmost top to the rightmost bottom on an image have been scanned during the display of display image data for turning a page on the screen. As is on usual display devices, the scanning is carried out in the direction from the leftmost top point on a scene to the

rightmost lower end thereon.

If a scan of the addresses of the display image data storage has not been accomplished, the address generator advances the address to a subsequent not-yet-scanned address (Step S8).

In case when the current scanned address is the last address, i.e., the value "c" of the counter satisfies the condition  $c \geq q$ , the display changeover control portion finishes the page-turning operation and waits for a next request for turning pages (Step S9).

If  $c < q$ , then a constant K is added to the counter (Step S10). K determines the number of display image-data columns to be skipped. For example,  $K=1$  denotes all columns are displayed, while  $K=2$  denotes columns are displayed on the basis of one column for each two columns. The value of K may be preliminarily fixed by the display changeover control portion or may be changed according to information input and observed on the input portion of Fig. 1. The information observable on the input portion is, for example, a speed or strength of a stroke or a gesture input through the input portion. This makes it possible to control a page-turning speed and/or degree depending upon the observable information.

In Step S10, a time necessary for turning a page with  $K=1$  is represent by  $T_f$  and, therefore, a time necessary for turning a page with  $K=3$  can be determined as  $T_f/3$ .

It is also possible to turn pages in the reverse direction by preliminary setting the value K to, e.g., -1, setting the

value "q" as an initial value of the counter in Step S2 and the condition  $q \leq 0$  for Step S9 and selecting a reverse memory by the memory selector.

The data stored in the page turning data storage portion is as follows:

Fig. 11 illustrates transition states of turning pages in the display image data storage portion at time points T0, T2, Tp, Tp+2 and Tq. In Fig. 11, it is assumed that A is a display preparation image memory for image data of a page being displayed and B is a display preparation image memory for image data of a page to be displayed next.

In the exemplary page-turning data of Fig. 2, it is seen that data columns 0, 1, 2, 3 from the memory B is selected as data to be transferred at a time point T2 to display image data columns 0, 1, 2, 3 of the display image data storage portion, while data columns 0, 3, M, N from the memory A is selected as data to be transferred at the same time point T2 to display data columns 4, 5, M and N.

At the time point Tp+2 (Fig. 2), data columns M+M/4, M+M/2, M+3M/4 and N from the memory B is transferred to display image data columns M+1, M+2, M+3 and M+4, respectively, of the display image data storage portion.

As described above, the arrangement of the page-turning data in the page-turning data storage portion as shown in Fig. 2 makes it possible to cause an image to change with time as if one turned pages of an actual paper book.



The natural flexible turning of pages can be realized by changing values of the page-turning data table since the page-turning data table is obtained without using any arithmetic operational circuit.

Although the page-turning data storage portion has been described as differing in construction from the image data storage portion, the former may be made common with the latter portion so that the page-turning data can be stored together with the image data in a common image data storage portion. In this case, the image data control portion stores page-turning data together with image data of the image data storage portion in the display preparation image data storage portion. The display changeover control portion receives the above page-turning data from the display preparation image data storage portion instead of the turning-data storage portion. The other processing steps are similar to those described in the above example.

The page-turning data storage portion may use a ROM or a rewritable ROM such as a flash ROM or EEPROM, which may be used in the same way as the above described. In case of using the rewritable ROM with page-turning data of Fig. 2, if a feeling of page-turning on the device is different from that of page-turning of an actual paper book, it is possible to realize more natural turning of pages with visually impressive movement of pages or in accord with the user's eye characteristics by rewriting page-turning data.

It is also possible to use in pairs the column information storage table and image data. In this instance, Step S1 (Fig. 4) is changed as follows:

In Step S1, the image data control portion calls page-turning data together with the data of a page to be displayed next and the display changeover control portion transfers the page-turning data to the column information storage table.

Fig. 12 depicts how to process a request for turning pages, which is input through an input portion of an electronic book display device according to the present invention. A contour of the device is shown at 61. A white portion is a display portion. In this embodiment, a pen tablet that is an input device with a display unitarily formed therewith. The pen tablet can sense a speed of the pen moving thereon. In Fig. 12, a direction and a speed of movement of the pen is indicated by an arrow and its line length respectively. For example, arrow 62 represents the pen moving slowly to the right. Arrow 63 represents that the pen slowly moves to the left, while arrow 64 represents that the pen fast moves to the right. For example, the rightward movement of the pen is indicated by a positive sign (+), the leftward movement of the pen is indicated by a negative sign (-) and a maximal and minimal speeds of the pen movement, which can be detected by the input portion, are represented by  $v_{max}$  and  $v_{min}$  respectively. Turning a page in accord with the movement of the pen can be realized by setting K-value to an integer, i.e.,  $K=q$  at  $v_{max}$  and  $K=1$  at  $v_{min}$ . In the other words,

the use of the tablet being an integral input-display portion makes it possible to control page-turning based upon information input through the input portion.

In the integral input-display type pen tablet device, a pointing device may be a pen and/or a finger.

The tablet device can recognize a gesture of the pen by using a coordinate digitizing function of the pointing device. For example, it is possible to realize turning to a next page by writing a Japanese Hiragana character "の" with a usual stroke of the pen, turning to a preceding page by writing the character "の" with a reverse stroke of the pen, designating the number of pages to be skipped by a size of the character "の" and specifying a speed of turning a page in proportion to a speed of writing the character "の".

Figure 6 is a block diagram of an electronic book display control device according to a second embodiment of the present invention. This display control device comprises a central processing unit (CPU) 1 for controlling the whole device, an image data storage portion 2 for storing therein the contents of the book as image data, an image data control portion 3 for receiving the image data and performing required control, a display preparation image data storage portion 4 for storing image data of a page being displayed and image data of a page to be displayed next, a display portion 5 for displaying thereon information concerning the image data and information concerning the operation of the electronic book, a display

control portion 6 for controlling the display portion 5, a display image data storage portion 7 for storing data to be displayed on the display portion, an input portion 8 for inputting user's commands for operating the electronic book, a page-turning data storage portion 9 for storing data displayed on the display portion at a specified time for a page-turning period, a column information storage table 10 for storing column information of the page turning data, a display changeover control portion 11 including a selecting means for selecting an address of the display preparation image data storage portion and image data on a page being displayed and image data on a page to be displayed next according to the column information, and a data latch 12 for storing a part of image data.

Fig. 7 shows a detailed structure of the display changeover control portion of Fig. 6 and relevant portions disposed there around. A memory selector selects either of a memory "a" and a display image data storage portion. The data latch is disposed between the memory "a" and the display image data storage portion and exchanges data with the display image data storage portion.

The data latch is a memory that can temporally store 1 pixel data. It receives data of one pixel from the display image data storage portion, receives data of one pixel from the display preparation image data storage portion and transfers the received data to the display image data storage portion. The

shown structure of this embodiment is distinct from the structure of the embodiment of Fig. 3 only by the presence of the data latch, by which the capacity of the display preparation image data storage portion is saved by half in comparison with the embodiment of Fig. 3.

Figure 8 is a flowchart depicting the operation of the electronic book display control device of Fig. 6.

Referring to Fig. 8, the operation of the data latch of the display control device according to the second embodiment of the present invention will be described below.

Upon receipt of a request for displaying a next page from the input device, the CPU transfers the request to the image data control portion that in turn reads image data of a next page from the image data storage portion and writes the read-out image data of the next page into either memory "a" or "b" of the display preparation image data storage portion, which is not occupied with image data of the page being displayed (Step S11). Namely, the image data of the page to be displayed next is stored in the memory "b" if the image data of the page being displayed is stored in the memory "a".

Since a time point of reading image data corresponds to a time point T0 of beginning turning of a page, the display changeover control portion sets "0" at the counter (Step S12). At the time point T0, the address generator sets the leftmost top address (0, 0) as an address of the display image data and initializes the address (Step S13).

The display changeover control portion sends the count value 0 and the abscissa value (x coordinate) 0 to the column information storage table (Step S14). The display changeover control portion acquires a corresponding memory of the display preparation image data storage portion and the abscissa value (x coordinate) from the column information storage table (Step S15). Namely, the display preparation image data storage portion is selected and the abscissa value (x coordinate) is determined to be zero since the column is 0 and the time is T0.

The memory selector receives the above data and selects the memory of the display preparation image data storage portion and the display changeover control portion transfers the display preparation image data designated by the data latch as the above (Step S16). The display changeover control portion transfers display image data from the data latch to the display image data storage portion (Step S17).

On completion of scanning all the addresses of the display image data storage, the process advances to Step S20. Otherwise, the process advances to Step S19 (Step S18).

If a scan of the addresses of the display image data storage has not been accomplished, the address generator advances the address to a subsequent not-yet-scanned address (Step S19).

In case when the last address was scanned and the value "c" of the counter satisfies the condition  $c \geq q$ , the process is finished (Step S20). If  $c < q$ , then 1 is added to the counter

(Step S21).

Figure 9 shows an example of storing a difference between the current page data and the preceding page data in a table for storing column information of page-turning data that uses V and B instead of B and A (Fig. 2) respectively. V designates display image data storage portion and A designates the display preparation image data storage portion. The cell 4 at a time point T2 contains a value V,2. This means that the data existing in column 0 at time T0 moves to column 2 at time T1 and further to column 4 at time T2. In other words, the page-turning data shown in Fig. 9 is composed of a difference from the preceding page data. This can realize turning of pages like those of an actual book with no additional arithmetic circuit, i.e., with a saved memory capacity.

Fig. 10 is a block diagram of an electronic book display device that is a third embodiment of the present invention. This display control device comprises a central processing unit (CPU) 1 for controlling the whole device, an image data storage portion 2 for storing therein the contents of the book as image data, an image data control portion 3 for receiving the image data and performing required control, a display preparation image data storage portion 4 for storing image data of a page being displayed and image data of a page to be displayed next, a display portion 5 for displaying thereon information concerning the image data and information concerning the operation of the electronic book, a display control portion

6 for controlling the display portion 5, a display image data storage portion 7 for storing data to be displayed on the display portion, an input portion 8 for inputting user's commands for operating the electronic book, a page-turning data storage portion 9 for storing data displayed on the display portion at a specified time for a page-turning period, a column information storage table 10 for storing column information of the page-turning data, a display changeover control portion 11 including a selecting means for selecting an address of the display preparation image data storage portion and image data on a page being displayed and image data on a page to be displayed next according the column information, a data latch 12 for storing a part of image data, and a selector 13 for selecting a desired memory to be referred when reading/writing the display preparation image data.

The selector 13 controls two memories "a" and "b" of the display preparation image data storage portion in such a way so as to transfer data between the memory "b" and the data latch while the memory "a" is connected to the image data storage portion and so as to transfer data between the memory "b" and the image data storage portion while the "a" is connected to the data latch.

The image data stored in the image data storage portion is divided so that it can be read in the order necessary for turning pages. Let us assume that image data is divided into eight blocks A-H and stored in the image data storage portion



as shown in Fig. 5(a). In each block, image data are arranged in ascending order of their column numbers. The blocks A, D, E and H contain even-column-numbered data and the blocks B, C, F and G contain odd-column-numbered data. In case of turning pages from left to right, data blocks A and B are read first until a next page is open to  $45^\circ$  (the page-turning state  $T_q/4$ ). After the state  $T_q/4$ , the image is displayed with thinned data columns. If the odd-numbered data blocks are read first, the data can be read in the order shown in Fig. 5 by subsequently reading the data blocks A, B, C, D, E, H, F, G.

The display preparation image data storage portion is divided into two in each of which eight blocks of divided-images are read by twos under the control of the selector 1. In this instance, as shown in Fig. 5(b), blocks A and B are read in the memory "a" and blocks C and D are then read in the memory "b". The memory "a" can be accessed from the data latch while reading blocks C and D is read in the memory "b". The memory "b" can also be accessed from the data latch while blocks E and H is read in the memory "a". Thus, reading image data from the image data storage portion and accessing from the data latch can be performed parallel in time. The above structure of the memory system is achieved by using memories "a" and "b" each having the capacity corresponding to a half of the image size.

According to the present invention, it is possible to turn pages of the electron book by controlling the column

information and display image data, thus realizing turning pages of the book just like opening a printed book by flexibly controlling images of the current page and the next page. The natural flexible turning of pages can be realized by changing values of the page-turning data table without using any arithmetic operational circuit.

It is also possible to turn pages in accordance with the contents of the image by storing column information storage table in the image data storage portion that stored the image data. Fast and flexible turning of pages can be also realized by storing the column information storage table in a ROM or rewritable ROM other than the image data storage portion. The control of image data on the page-by-page basis can be easily performed by pairing the column information table with the image data. This makes it possible to naturally turn pages just like turning pages of a printed book.

It is also possible to turn pages in accordance with the user's characteristics and the stories of the data to be displayed by reading the column information to the column information storage portion according to the information input and observed on the input-display portion.

It is further possible to save to half the capacity of the display preparation image data memory by the provision of the data latch for reading and storing the image data from the display preparation image data portion.

It is possible to further reduce the capacity of the display

image data memory by storing, in the column information storage table, information on a difference between the current page data and the preceding page data.

It is also possible to reduce a time necessary for turning pages by using an input selector and an output selector provided for selecting memories at an input-output portion of the display preparation image data storage portion.

It is further possible to naturally turn pages of the electronic book with a reduced capacity of the memory by dividing the image data stored in the image data storage portion into blocks thinning it to be readable in the order necessary for turning pages and by thinning the data.

An example of using an electronic book display control device as a reproduction display device will be described below. This electronic book display device reproduces the digital data of electronic book data (hereinafter, referred to as "book data") of magazines and novels and comics as the data for reproduction. It is also applied for a general reproductive display device such as an image filing device for reproducing different digital data.

Fig. 13 is a block diagram of electronic book display device according to the present invention. In Fig. 13, a reproduction display device comprises a central processing unit (CPU) 101 being a control means, a ROM 102 for storing a system control program, a RAM 103 for storing program a working area for executing the program and storing book data such as page data,

a input means 104 such as a communication line and a disk drive for reading book data stored on a recording medium and reproducing the read data, a display means 105 for display book data, audio output means 106 for outputting audio book data recorded on a recording medium, a page-turning requesting means 107 allowing the user to specify a mode of turning pages of the electronic book at a high speed or at a usual speed (by using, e.g., buttons), a display mode changeover requesting means 108 allowing the user to select any one of page-data display modes, and a CPU bus 109 for interconnecting the above components of the device. According to the control program stored in the ROM 102, the CPU 101 controls the input means 104, display means 105 and audio output means 106 to reproduce and display the book data and performs various kinds of processing by the user's request input through the page-turning requesting means 107 or the display mode changeover requesting means 108. The display means 105 is composed of a display control means 1051 for controlling the contents to be displayed on a display screen and a display screen 1052.

Figure 14 shows an external appearance of the electronic book display device according to the present invention. In Fig. 14, the device includes all components shown in Fig. 13, wherein the display screen 1052 has a bonded thereon touch-sensitive resistive-film tablet that is used as the display mode changeover requesting means 108 and the user's request inputting means. Buttons provided on the tablet is also used

as the page-turning requesting means 107 by which the user can request the device to turn pages at a normal speed or a high speed. Numeral 111 designates an inlet for inserting a recording medium carrying a record of a book data and numeral 112 designates a pen for inputting the request for changing the display mode or other kinds of requests and commands.

Figure 15 schematically illustrates a format for storing data of a book to be displayed on this electronic book display device. As shown in Fig. 15, the book data is composed of management data area including book information (e.g., title) and page information (e.g., the size of each page) and a page data area wherein page data corresponding to the text of book data is divided and stored on page-by-page basis. The data is recorded on a recording medium such as an IC card and a disc.

Figure 16 illustrates an exemplary structure of a management information area of book data. In the management information area, there is stored an identifier for indicating a management information area, a data size showing the size of this area, a book information area for storing a title of the book, the author's name and a page information area for storing a page size and the number of pages. Each page has a coordinate system imaginarily provided thereon with an origin disposed at the top left vertex of the page. A page area of each page size has a record of coordinate values of its bottom right vertex in this coordinate system. In Fig. 16, a numeric value in each right column shows the number of bytes to be

stored.

As shown in Fig. 17, each page is composed of element data (hereinafter referred to as objects) such as character data, image data, audio data and video data.

Namely, respective objects are arranged on an imaginary page having a page size defined in the page information area as shown in Fig. 16. Audio data not to be displayed is imaginarily disposed on a whole page or in a relevant area.

Figure 18 illustrates a method for storing data of each page in a page data area (in Fig. 15). Each page data includes a page data identifier showing the subsequent information concerning page data, a data size showing the number of bytes of the page data, the number of objects composing page data, and object data areas each storing data of each object. In Fig. 18, each numeral in each right column shows the number of bytes to be recoded.

Figure 19 depicts a method for storing object data in each object data area. As shown in Fig. 19, the object data area is composed of an object data area identifier declaring this area is the object data area, a data size of this area, a data classification identifier, coordinate values of an origin and an end point for recording a top left position and a bottom right position of a rectangular area in which the object is located, a reproduction identifier determining whether the object is reproduced when fast turning of pages is requested, and an actual data area for storing actual object data.

In Fig. 19, the high-speed page-turning reproduction identifier is used for setting, at the stage of preparing book data, an important object or an object being significant only for particular contents to be reproduced at a high speed. It is also used for setting the identifier at a specified interval of pages to present an image of the book as if its pages were ruffled. In Fig. 19, each numeral in each right column shows the number of bytes to be stored.

The data classification identifier in Fig. 19 is used for specifying a kind of the object and a method of storing the object. In Fig. 20, there is shown a table showing the correspondence of data classification identifiers to data classification in Fig. 19. Namely, the classification of an actual data area and a method for storing actual data can be recognized by reading the value of a data classification identifier.

A practical method for storing actual data in an actual data area will be described below:

Large-size data such as image data, audio data and video data requires a lot of time to read from the recording medium, which makes it difficult to create scenes of high-speed turning of pages. Therefore, such data is divided as necessary into summary data and remaining data, which are then separately stored. The summary data is used to display images of high-speed turning of pages. In case when the summary data and the remaining data are compressed and stored, it is necessary to

provide an information area for designating a method of compressing the summary data in different from a method of compressing the remaining data (as necessary) for the following reason:

The data to be used for fast turning of pages is preferably less compressed so that the data may be read from the recording medium, thawed (expanded) and displayed for possibly short period. On the contrary, the book data composed of the images, audio and video each containing a large amount of data is usually required to be compressed to a smallest data size. In particular, the book data having no need of being displayed at a high speed is highly compressed even with an elongated time of expansion. Consequently, it is preferable to compress and store the summary data required for fast reproduction in different from the remaining data not required for fast reproduction. For example, the summary data is compressed by the run length encoding method that can encode the data for a short time while the remaining data is compressed by the arithmetic-arithmetic encoding method that requires time but can highly compress the data.

Figure 21 depicts a method for storing usual image data defined by a data classification identifier of 0x40. The data of this format is stored in an actual data area shown in Fig. 19. In Fig. 21, a numeral in each right column shows the number of bytes to be stored. The same is applied to the structure of actual data to be described below.



As the number of bytes is known, desired data can be read by specifying the desired number of bytes. As shown in Fig.21, the numbers of pixels in rows and columns of an image, the number of image planes, information designated according to compression method for each plane image, offset information on the number of bytes representing position of an actual image from an initial position of an actual data area and data of each actual plane image are stored in the described order. The each plane image is compressed by the designated compression method. For a mono-chromatic image, the number of planes is set to 1 and image data is stored only in the first plane image area. For a color image, data are represented by YUV color system adopted by JPEG, the number of planes is set to 3, a Y-plane image, a U-plane image and a V-plane image are compressed by corresponding designated compression methods and stored in the first, second and third plane areas respectively. In the YUV color system, the Y-plane image is of luminance components of the original image, which can be used as summary data of the original image. Therefore, only Y-plane images are read and displayed for expressing turning pages of a book at a high speed.

It is also possible to use, instead of the YUV color system, the YCrCb color system in which image data is represented by luminance signal and color difference signal and, in this instance, the luminance signal is used as the first-plane image, and the RGB color system in which the G-plane image may be stored

in the first plane image.

For image data of the type defined by the data classification identifier 0x41, each image is decomposed into bit-plane images: A bit-plane image composed of a most significant bit (upper bit) of each pixel is first stored and a subsequent bit-plane image composed of a second bit of each pixel is stored next and so on. Figure 22 is mimic illustration of a method for decomposing an image data composed of pixels having each 3 bits into bit-plane images. At the top is image data before decomposition, whose pixel values are recorded each by 3 bits. The image is decomposed to form a first bit-plane image by the first bit of each pixel, a second bit-plane image by the second bit of each pixel and a third bit-plane image by the third bit of each pixel.

The concept of Fig. 22 (for the image whose pixels are composed of 3 bits respectively) can be easily expanded to an image whose pixels are composed of  $n$  bits. For a color image, a R-plane image, a G-plane image and a B-plane image are processed respectively as shown in Fig. 22: an  $i$ -th bit-plane image is formed by  $i$ -th bit of a pixel of the R-plane,  $i$ -th bit of a pixel of the G-plane image,  $i$ -th bit of a pixel of the B-plane image and stored in the described order of pixels. This is based on the fact that an understandable summary image can be reproduced by using only bit-plane images each formed of only most significant bit or the several most significant bits. Therefore, it is useful to decompose images into

bit-plane images and read-out merely bit-planes composed of the most significant several bits for display scenes of turning pages at a high speed. This makes it possible to achieve high-speed reproduction of the images with a saved time for reading data from the recording medium.

Figure 23 illustrates a data format when storing image data in the form of bit-planes. The data is stored in the actual data area shown in Fig. 19. As shown in Fig. 23, the number of pixels in rows and columns of an image, the number of bit planes, information on a designated compression method for each plane image, offset information on the number of bytes representing position of an actual image from an initial position of an actual data area and data of each bit plane image are stored in the described order. The each bit plane image is compressed by the method designated in terms of the compression method.

For image data of the type defined by the data classification identifier 0x42, each image is decomposed into two bit planes i.e., a bit-plane image composed of only a most significant bit or several more significant bits of each pixel and a bit-plane image composed of remaining bits of each pixel. Two bit-plane images thus obtained are separately stored. Figure 24 is mimic illustration of a method for decomposing an image of pixels having each 4 bits into two bit-plane images. At the top is image data before decomposition, in which pixels are composed of 4 bits. The image is decomposed to form a

significant bit-plane image by top and second bits of each pixel and an insignificant (lower) bit-plane image by the third and fourth bits of each pixel. Two resultant images are shown in Fig. 24(a). The image can also be decomposed into two images, one of which is composed of only a most significant bit of each pixel and the other is composed of remaining bits of each pixel.

The concept of Fig. 24 (for the image whose pixels are composed of 4 bits) can be easily expanded to an image whose pixels are composed of  $n$  bits, so it is not restricted to 4 bits. For a color image, a R-plane image, a G-plane image and a B-plane are processed respectively as shown in Fig. 24: a significant bit-plane image formed from plane images R, G and B are stored as a significant bit-plane image and an insignificant bit-plane image formed from bit-plane images R, G and B is stored as an insignificant bit-plane image.

Figure 25 illustrates a data format when storing image data in this form of bit-planes. The data is stored in the actual data area shown in Fig. 19. As shown in Fig. 25, the numbers of vertical and horizontal pixels of an image (the number of pixels in rows and columns of an image), compression methods for the significant bit plane image and the insignificant bit plane image, the number of bits from each pixel for forming the significant bit plane image and the insignificant bit plane image, the significant bit plane image size and data, and the insignificant bit plane image size and data are stored in the described order. The significant bit plane image and the

insignificant bit plane image are compressed by the methods designated in terms of the compression methods respectively. Storing image data by this form makes it easy to read only summary image data formed of significant several bits. To display image data of the type defined by the data classification identifier 0x41, it is necessary to read several bit-plane images formed of several most significant bits and synthesize them. On the contrary, the shown data storing method stores most significant bit plane images formed of several most significant bits of each pixel, thus omitting the synthesizing process and thereby achieving faster turning of pages.

For image data of the type defined by the data classification identifier 0x41, the page turning speed can be adjusted in several steps by adjusting the number of bit-plane images to be read. In contrast, the described data storing method can adjust the page turning speed in two steps by reading only the most significant bit plane image or both bit plane images. For image data of the type defined by the data classification identifier 0x43, a thinned image formed by sampling pixels one for every several pixels in vertical and horizontal directions from an original image and an image formed of remaining pixels are stored separately from each other.

Figure 26 illustrates how to produce a thinned image by sampling one for every three pixels from the original image. In Fig. 26, each square in a grating represents one pixel. From

the original image shown left in Fig. 26, pixels are subsequently taken one for every three pixels (marked by mesh) in vertical and horizontal directions and arranged in the same order as in the original image. This produces a thinned image as summary data of the original image. This thinned image is read to use when turning pages at a high speed, thus saving time necessary for reading image data from the recording medium. Figure 27 shows an exemplary format for storing a thinned image. The data in this format is stored in an actual data area shown in Fig. 19. The numbers of vertical and horizontal pixels of an image, compression methods for the thinned image and the remaining pixel data, the sampling interval, the data size of the thinned image, the remaining pixel data size and the remaining pixel data are stored in the described order. The thinned image data and the remaining pixel data are compressed by the designated methods respectively.

A format for storing video data to be used for presenting high-speed turning of pages will be described below. Figure 28 shows a format for storing usual video data (with a data classification identifier 0xA0) and Figure 29 shows an exemplary format for storing video data for presenting high-speed turning of pages (with data classification identifier 0xA1). As shown in Fig. 28, usual video data is recorded in the form of the number of vertical and horizontal pixels of the video area, designation of a method for compressing frame data and the format of video data. Each frame

data is compressed by the designated method and stored together with its frame data size in order of time. The video storing format of Fig. 29 provides an additional area of a representative frame data. Several representatives of time-sequential frame data composing video data are selected, compressed by the designated method and stored together with frame number (counted from the top frame) and frame data size in the above additional area. Other frames are also compressed respectively by the designated method and stored in order of time in a remaining video data area shown in Fig. 29. The method for storing each frame data in the remaining video data area is the same as that of the frame data shown in Fig. 28. Sets of frame data size and frame data per frame are stored in order of time in the above remaining video data area. In the high-speed page-turning mode, only representative frame data area is read, thus reducing time required for reading data from the recording medium and reproducing the data.

When retrieving a desired page by turning pages, one may often search it by using position information on each page. For this purpose, all objects have position information on each page. When the user designates an area, objects included at least partly in the designated area are retrieved and reproduced. However, a large object projecting out of the designated area may be read with its unnecessary portion, i.e., with the loss of time. Especially, a large object occupying a large area of the display screen may bring a large loss of

time. In view of the above, each large object is divided in advance into several areas and stored. This makes it possible to easily retrieve and display a data area of the object, which substantially meets the area designated by the user.

Figure 30 mimetically illustrates how to divide image data into blocks each of a specified size (bx X by). As shown right in Fig. 30, image data for each division of the image is stored as a unit. In this instance, data classification identifier is of 0x44. Figure 31 shows a method for storing image data divided into several blocks. As shown in Fig. 31, the numbers of vertical and horizontal pixels of the image and a compression method for each block are first stored, then the number of horizontal pixels of each block and the number of vertical pixels of each block are stored. Each block images including data size and block image data are then stored in order of so-called TV-raster scan. The block image data is compressed in advance by the designated method. The retrieval is now performed by reading only blocks included at least partly in an area designated by the user, thus reducing the loss of time for reading excessive portion of the object. This contributes to fast turning of pages of a book on the display screen. This division-to-block storing method may be also applied to each bit plane image having a data classification identifier 0x41 or 0x42, a thinned image of 0x43 and each frame data of 0xA0 or 0xA1.

The operation of the electronic book display device is



described below with reference to flowchart of Fig. 32.

This device provides two display modes: a normal reading mode in which a page is turned to a next every time when a command for turning a page is input through a page-turning requesting means 107 and a high-speed (fast) page-turning mode in which pages are fast turned for example for retrieving a desired page. When the device is powered, it works in the normal reading mode and transits into the high-speed page-turning mode when the user inputs a request for changing over the mode through a display mode changeover requesting means 108 while displaying a page data. In practice, the current normal reading mode is turned over to the high-speed page-turning mode when the user clicked a mouse on a mode-changing button indicated on the display screen. The operation in each mode is as follows:

Referring to a flowchart of Fig. 32, the operation of the device in the normal reading mode is first described as follows:

In Step S100, the display page is set to a given page. The given page to be opened just after turning on the power is a front page of a book or a page having been displayed last in the last time. When the mode is changed, the given page is the page having been opened in the preceding mode. On the set page, the number of objects is read from the set page data area (Step S101). The object data per each of objects composing the page is read from the recording medium (Step S102), the data is processed for reproduction in accord with the value of the data classification identifier (Step S103). In Step S104, it

is checked whether all objects within the page have been processed or not. If any object has not yet be processed, the process returns to Step S102 for processing the object to be reproduced. If all objects have been processed, the process advances to Step S105.

Step S103 is supplemented by following: The processing in Step S103 is switched over in accord with the value of the data classification identifier. For example, with the data classification identifier having a value of 0x41, each bit-plane image is read and thawed (expanded) at Step S102 and restored to form the initial image to be displayed on the display screen. For example, a monochromatic image having pixels whose values being recorded each by n bits is processed as follows:

Expressing each bit-plane image as  $B_i(x, y)$  ( $i=0, \dots, n-1$ : the smaller  $i$  is, the more significant bit-plane image is), the initial image  $I(x, y)$  is restored and displayed by calculating the equation for each pixel:

$$I(x, y) = \sum_{i=0}^{n-1} B_i(x, y) \times 2^{n-i-1}$$

For an object with a data classification identifier of 0x42, an initial image (before decomposition) is restored from a significant bit-plane image and an insignificant bit-plane image, which were read and thawed at Step S102. For example, if the image before decomposition is monochromatic and the significant bit-plane image  $U(x, y)$  is composed of significant

n bits and the insignificant bit-plane image  $D(x, y)$  is composed of insignificant m bits, the initial image  $I(x, y)$  can be restored and displayed by calculating the following equation for each pixel:

$$I(x, y) = U(x, y) \times 2^m + D(x, y)$$

For image data with a data classification identifier 0x43, an initial image is restored from a thinned image and remaining pixel data by using the specified pixel-sampling interval for the data and the restored image is displayed.

For video data with a data classification identifier 0xA1, representative frame data in a representative frame data area and frame data in a remaining video data area are rearranged in order of time with reference to frame numbers in the representative frame data area and, then, frame data is displayed in order of time at a specified time interval.

For image data with a data classification identifier 0x44, each block image is thawed (expanded) and a position of each block in the initial image is determined from the numbers of vertical and horizontal pixels of each block and the numbers of vertical and horizontal pixels of the image before decomposition, and the initial image is synthesized from the image blocks and displayed.

On completion of outputting all objects composing the page being displayed, Step S105 examines whether a request for turning the page is input from the page-turning requesting means 107. If the request is given, the page number is changed

to that of the page to be displayed at Step S108 and the process returns to Step S101 whereat the designated page data is processed to reproduce and display the page data. With no request for turning the page, Step S106 further examines whether a request for changing the current mode is input through the display mode changeover requesting means 108. If the request is given, then the process transits to processing of display data in the high-speed page-turning mode.

With no request for changing the display mode, Step S107 examines whether the user requests for finishing the reproduction of the page data. If so, the reproduction of the book data is finished (Step S109). With no request for finishing the reproduction of page data, the process returns to Step S105 and, then, Steps S105 to S107 are repeatedly performed until the user's request regarding any of Steps S105 to S107 is input.

Referring now to the flowchart of Fig. 33, the operation of the device in the high-speed page-turning mode will be described below.

When the display mode was changed from the normal reading mode to the high-speed page-turning mode, the device presents on its display screen a window in which the user can set conditions for reproduction of page data in the high-speed page turning mode as shown in Fig. 34 (Step S200). Step S200 is further described below in detail.

As shown in Fig. 34, the reproduction conditions are mainly classified to four contents: data classification, data size,

position designation and only objects designated by the author. The objects to be reproduced are selected by a logical product of the conditions selected by the user.

The example shown in Fig.34 requires the device to select and reproduce only object(s) that satisfies the two restrictions of "data classification" and "position designation". In this instance, the data size and the designation by the author are neglected.

The data classification is to restrict the reproducible object by each data classification.

The reproducible object(s) is restricted to one, several or all of four types: character, image, audio and video. For example, if one remembers an image on a certain page or sound listened from a certain page of the book and wants to find that page by the image or sound, this feature item is effective to use. If character and image are selected in the window shown in Fig. 34, the device reads the value of the data classification identifier for each object data for reproduction from the recording medium when opening each page. The device then reads only object data identified by an identifier 0x01 (for character data) and identifiers 0x40, 0x41, 0x42, 0x43 and 0x44 (for image data) in the actual data area and reproduces them. The device skips sound data and video data contained in the page without reproducing them by recognizing the data size shown in Fig. 19. The data classification allows the user to set further detailed condition on reproduction of

page data. Namely, the user clicks the mouse on the button "Detail" on the display screen, by which a window shown in Fig. 35 is open on the display screen. This window allows the user to set the detailed conditions for each data classification. The conditions set thereat by the user will be reflected on the processing at Step S208.

Figure 35 presents a window in which the user can input settings for image data and video data. Namely, the user sets either one of two conditions for image data and video data respectively: all data in an actual data area are read and displayed just like turning pages in the normal reading mode or only summary data is displayed for the objects identified by data classification identifiers 0x40 (color image) and 0x41, 0x42, 0x43 (image data), 0xA1 (video data). However, monochromatic image (with identifier 0x40) and the object (with identifier 0xA0) have no summary data and they are displayed in the normal page-turning mode irrespective of the settings in this window. In case of displaying only summary data, it is further possible to flexibly set a desirable displaying rate of the summary data by changing the position of a setting knob.

For image data with the data classification identifier 0x41, the number of bit-plane images can be changed by selecting the position of a setting knob. For example, when the knob is set at a position dividing a line from the slow end to the fast and with an internal ratio of 2:1, merely the significant bit-plane images by  $n/3$  (each pixel is composed of  $n$ -bits) are

read and displayed.

For image data with the data classification identifier 0x43, a thinned image is read and displayed in enlargement if the knob is set at a position closer to the slow side, while merely a thinned image is read and displayed without enlargement if the knob is set at a position closer to the fast side. Namely, magnification of the thinned image can be changed by regulating the position of the knob.

For color image data with data classification identifier 0x40, the first plane image is read and displayed irrespective of the setting knob.

For image data with data classification identifier 0x42, only a significant bit image is read and displayed irrespective of the setting knob.

For video data with data classification identifier 0xA1, the number of frames (data) from the representative frame data area can be changed by changing set position of the knob. Namely, the position of the knob changes the number of frames from one to the number of frames, which is registered in the representative frame area.

In Fig. 35, only image data and video data can be set but setting items for character data and sound can be added to the items in the window.

In the window of Fig. 34, a value set in the item "data size" simply restricts the reproducible objects by the data size. Since all objects are stored in the format shown in Fig.19,

the device examines data sizes of the objects therein, reads and reproduces only objects having smaller size than the threshold input by the user.

A settable item "Position designation" in the window of Fig. 34 restricts reproducible objects by the area of the page in which objects are disposed.

An area (position) is designated by inputting the coordinate values in the blanks of the item. It can be also designated on a whole image on the display screen by pointing with pen at a left top point and a right bottom point of an area.

A settable item "Only Objects designated by the Author" in the window of Fig. 34 is used for selecting reproducible objects based on the contents (with a reproduction identifier when turning pages at a high speed) set in advance for each object by the author. Once this item is selected, the device selects and reproduces only objects designated by the author by using the above identifier while turning pages at a high speed.

In Step S200, when the reproduction conditions are set, then the device reads value in the area "the number of objects" in the page data stored in the format of Fig. 18 (Step S201), performs the loop processing of Steps S203 to S209 by the number of objects. On completion of processing for all objects, the process transfers from Step S202 to Step S210.

In detail, if any unprocessed object was found in Step S202, the process transfers to Step S203 whereat among object data



stored in the format shown in Fig. 19, data in an area other than the actual data area is read. In Step S204, the device examines whether the read value of the data classification identifier meets the reproduction conditions set by the user in Step S200. If no selection of the data classification identifiers was made in Step S200, the examination is not performed in Step S204 and the process advances to Step S205. On the contrary, when the restriction of the data classification was made in Step S200, the device examines whether the object being reproduced corresponds in its classification to the object designated by the user to be reproduced. If so, the process advances to Step S205 for processing the object data. If not, the process transfers to Step S202 for processing the next object. Step S205 further examines whether the data size of the object being reproduced falls in the range specified at Step S200.

A data size value in the data size area of the object data stored in the format of Fig. 19 is examined and a size other than the actual data area is subtracted therefrom. The resultant value is examined whether it falls within the range specified by the User. If so, the process advances to Step S206. If not, the process returns to Step S202 for processing the next object.

If no designation of the data size was made at Step S200, the above examination is not performed at Step S205 and the process advances to Step S206 whereat the device examines

whether the object being reproduced exists in the area designated by the user.

Referring to the area "coordinate values of the origin and end point" (Fig.19), the device examines whether the object is included at least at its part in the area designated by the user at Step S200. If so, the process advances to Step S207. If not, the process returns to Step S202 for processing the next object. If the position designation was not made at Step S200, the examination is not performed at Step S206 and the process advances to Step S207. In Step S207, the device examines a value in the area "Reproduction identifier when turning pages at a high speed" for the object being reproduced and advances the process to Step S208 if the value was set to be reproduced when turning pages at a high speed. If not, the process returns to Step S202 for processing the next object. If the author's object designation was not selected at Step S200, the above examination is not performed at Step S207 and the process advances to Step S208. In Steps S208 and S209, objects that has not restricted by the Steps S204 to S207 are processed and reproduced. In Step S208, the object data is read according to the data classification identifier and the contents set at Step S200 for the object and outputted as necessary.

The procedure of Step S208 for an object identified by the data classification identifier 0x40 is shown in Fig. 36. First in Step S300, the device examines whether the data classification is selected as a restriction item at Step S200.



pixels composing the image) (Step S404) and the process advances to Step S405. If only the summary data display is selected (not normal display), the process advances to Step S403 at which the number of bit planes to be read is calculated from the set position of the setting knob. The process then advances to Step S405 whereat the calculated number of bit-plane images are read from the recording medium and thawed (expanded) as necessary. The read plane images are processed by converting its optical density (Step S406) to produce display image. For example, a monochromatic image having pixels whose values being recorded each by n bits is processed as follows:

Expressing each bit-plane image as  $B_i(x, y)$  ( $i=0, \dots, n-1$ : the smaller i is, the more significant bit-plane image is) and the number of read bit-planes as pnum, the display image  $I(x, y)$  is determined by calculating the following equation for each pixel:

$$I(x, y) = \sum_{i=0}^{pnum-1} B_i(x, y) \times 2^{n-i-1}$$

On completion of Step S402, the process returns to Step S209 to display the prepared display image.

The procedure of Step S208 for an object identified by the data classification identifier 0x42 is shown in Fig.38. First in Step S500, the device examines whether the data classification is selected as a restriction item at Step S200. If not, only a significant bit-image is read from the recording medium (Step S503) and thawed (expanded) as necessary. The

process then advances to Step S504. If the data classification is selected as a restriction item, the device examines the contents of the detailed data classification settings to see whether the normal display of the image data is selected (Step S501). If so, both the significant bit image data and the insignificant bit image data are read from the recording medium (Step S502) and thawed (expanded) as necessary. The process then advances to Step S504. If only the summary data display is selected, the process advances to Step S503 at which only a significant bit-image is read from the recording medium and thawed (expanded) as necessary. The process then advances to Step S504 at which a display image is generated from the image data read at Step S502 or S503. For example, the image before decomposition is monochromatic and the significant bit-image  $U(x, y)$  is composed of significant  $n$  bits and the insignificant bit-image  $D(x, y)$  is composed of insignificant  $m$  bits. The display image  $I(x, y)$  is determined by calculating the following equation for each pixel:

$$I(x, y) = U(x, y) \times 2^m + D(x, y)$$

in case of reading both the upper-bit-image and the lower-bit-image;

$$I(x, y) = U(x, y) \times 2^m$$

in case of reading only the significant bit-image.

The image prepared for display is displayed at Step S209.

Figure 39 is a flowchart depicting the procedure of Step S208 for the object with a data classification identifier 0x43.

First in Step S600, the device examines whether the data classification is selected as a restriction item at Step S200. If not, the process advances to Step S606 at which the thinned image data is read from the recording medium and thawed (expanded) as necessary. The process then advances to Step S607 at which the thinned image is enlarged by a factor of a pixel-sampling interval value referring to thinning interval value in Fig. 27 and then displayed (Step S209). If the data classification is selected as a restriction item (Step S600), the contents of the detailed data-classification settings are examined (S601). If the image data is set for normal display, the image data is read from the recording medium in the same manner as in the normal reading mode and the initial image data is restored (Step S602, Step S603) and displayed (Step S209).

If only the summary data display is selected (Step S601), the thinned image data is read from the recording medium and thawed (expanded) as necessary (Step S604). The position of setting knob position is examined in the image item in the window of Fig. 35 and a magnification factor of the thinned image is calculated (Step S605). For example, when the setting knob exists at a position dividing a line from "Fast" end to "Slow" end in the ratio of  $s:(1-s)$  (where,  $0 \leq s \leq 1$ ) and a pixel-sampling interval of the thinning image is  $t$ , the magnification is determined according to the following equation:

$$\text{Magnification} = s \times t + (1-s) \times 1$$

The thinned image is enlarged by the above magnification (Step S607) and the enlarged image is displayed at Step S207.

The procedure of Step S208 for an object identified by the data classification identifier 0x44 is shown in Fig. 40. First in Step S700, the device examines whether the position designation is selected as a restriction item at Step S200. If not, the device carries out the same procedure that it does in the normal reading mode: the device reads all data (Step S703), restores an initial image (Step S704) and displays the restored image (Step S209). If the position designation is selected as a restriction item (Step S700), the device selects all block images included at least partly in an area designated by the user by searching them by the position of each block on the page, where the position is calculated by the numbers of vertical and horizontal pixels and the numbers of vertical and horizontal pixels in block (Step S702). The device then reads the selected block image data from the recording medium, thaws (expands) the data as necessary (Step S702), correctly rearranges the read block images to form a display image (Step S704) and then displays the display image at Step S209.

The procedure of Step S208 for an object identified as video data by the data classification identifier 0xA1 is shown in Fig. 41. First in Step S800, the device examines whether the data classification is selected as a restriction item at Step S200. If not, the device reads data in the representative frame data area in the format shown in Fig. 29 from the recording

medium, thaws (expands) data as necessary (Step S806) and then displays the frame data in order of time at a specified time interval on the display screen (Step S209). If the data classification is selected as a restriction item (Step S800), the device examines the contents of the detailed data classification settings to see whether the normal display of the video data is selected (Step S801). If so, the device carries out the same procedure that it does in the normal reading mode: i.e., the device reads all data (Step S802), rearranges the frame data in order of time (Step S803) and reproduces the video data (Step S209). If only the summary data display is selected for the item "Video Data" at Step S801, the device calculates the number of reproducible frames from the position of the setting knob (Step S804) and selectively reads from the recording medium data of the frames by the determined number in the representative frame data area in such a way that the frames may be arranged in order of time and/or at the same time interval. The device then thaws (expands) the data as necessary (Step S805) and reproduces the video data (Step S209).

The procedure of Step S208 for objects stored in other format is the same as that of normal reading mode. However, if objects are specially devised for turning pages at a high speed, they may be differently processes.

When all objects existing on the page being displayed have been completely processed in Steps S203 to S209, the process



transfers from S202 to S210.

The processing in Steps S210-S214 is similar to the processing in Steps S105-S109.

As described above, by devising format for storing each object data composing page, the electronic display control device of the present invention can easily read only necessary object data from the recording medium and reproduce the data, thus realizing high-speed turning of pages according to the present invention.

The electronic book display control device of the present invention can easily read a part of data containing various kinds of object data such as characters, images, audio and video, thus realizing high-speed turning of pages for quick retrieval of a desired page.

## CLAIMS

1. An electronic book display control device comprising:  
a central processing unit for controlling the whole device;  
an image data storage portion for storing therein contents of  
a book as image data; an image data control portion for  
receiving the image data and performing required control; a  
display preparation image data storage portion for storing  
image data of a page being displayed and image data of a page  
to be displayed next; a display portion for displaying thereon  
information concerning the image data of the contents of the  
book and information concerning operation of the electronic  
book; a display control portion for controlling the display  
portion; a display image data storage portion for storing data  
to be displayed on the display portion; and an input portion  
for inputting user's command for operating the electronic  
book, wherein it is further provided with a page-turning data  
storage portion for storing data displayed on the display  
portion at a specified time for a page-turning period, a column  
information storage table for storing column information of  
the page-turning data and a display changeover control portion  
including an address producing portion for producing an address  
of the display preparation image data storage portion from the  
column information and a memory selecting portion for selecting  
a memory for storing image data of the page being displayed  
or a memory for storing image data of the page to be displayed

next.

2. An electronic book display control device as defined in claim 1, wherein the column information storage table is stored in the image data storage portion storing the image data.

3. An electronic book display control device as defined in claim 1, wherein the column information storage table is stored in a ROM or a rewritable ROM other than the image data storage portion.

4. An electronic book display control device as defined in claim 1, wherein the column information table is paired with image data.

5. An electronic book display control device as defined in claim 1, wherein the display portion comprises a display having an input portion integrally formed therewith and the column information is read in the column information storage table according to information observably input by the input portion.

6. An electronic book display control device comprising: a central processing unit for controlling the whole device; an image data storage portion for storing therein contents of a book as image data; an image data control portion for receiving the image data and performing required control; a display preparation image data storage portion for storing image data of a page being displayed and image data of a page to be displayed next; a display portion for displaying thereon information concerning the image data of the contents of the book and information concerning operation of the electronic book; a

display control portion for controlling the display portion;  
a display image data storage portion for storing data to be  
displayed on the display portion; and an input portion for  
inputting user's command for operating the electronic book,  
wherein it is further provided with a page-turning data storage  
portion for storing data displayed on the display portion at  
a specified time for a page-turning period, a column  
information storage table for storing column information of  
the page-turning data, a display changeover control portion  
including an address producing portion for producing an address  
of the display preparation image data storage portion from the  
column information and a memory selecting portion for selecting  
a memory for storing image data of the page being displayed  
or a memory for storing image data of the page to be displayed  
next, and a data latch for reading a part of the image data  
from the display image data storage portion and storing it  
therein.

7. An electronic book display control device as defined in  
claim 6, wherein a difference between data of a page being  
displayed and data of a page having been displayed just before  
the current page in the table for storing column information  
of the page-turning data.

8. An electronic book display control device as defined in  
claim 6, wherein an input selector for selecting a memory and  
an output selector for selecting a memory are provided on input  
side and output side of the display preparation image data

storage portion.

9. An electronic book display control device as defined in claim 8, wherein image data stored in the image data storage portion is divided to be readable in order necessary for turning pages.

10. A reproduction display device for reproducing and displaying element data in units of reproduction, wherein a partial data of the element data includes an identifier for high-speed reproduction and, when a request for high-speed reproduction signal is given, the partial data is reproduced and displayed successively.

11. A reproduction display device as defined in claim 10, wherein the partial data of the element data is compressed differently from other data.

12. A reproduction display device as defined in claim 10, wherein the element data is image data and the partial data is a significant bit image produced from a part of bits of each pixel.

13. A reproduction display device as defined in claim 10, wherein the element data is image data and the partial data is a part of bit-plane image formed by decomposing to bit-plane image.

14. A reproduction display device as defined in claim 10, wherein the element data is image data and the partial data is a thinned image produced by thinning respective pixels.

15. A reproduction display device as defined in claim 10,

wherein the element data is video data and the partial data is a representative frame image selected from the video data.

16. A reproduction display device as defined in claim 10, wherein the element data is image data and the partial data is one of divided images of an original image.

17. A reproduction display device as defined in claim 10, wherein the element data is image data or video data and a ratio of the partial data to be displayed is changeably set.

18. A reproduction display device as defined in claim 10, wherein it is further provided with a condition setting means for setting at least one of a data classification of the element data, a data size of the element data and position information of the element data in a unit to be reproduced, and the element data to be reproduced at a high-speed is selected according to conditions set by the condition setting means.

## ABSTRACT

An electronic book display control device capable of solving the problem of a conventional page turning method of an electronic book device that pages are turned in accordance with a value predetermined by a speed controller and hence it is difficult to turn pages flexibly in accordance with the contents of the book and the characteristics of the user. The control device is provided with a CPU (1) which controls the whole device, an image data storage unit (2) in which the contents of the book are stored as image data, an image data control unit (3) which receives the image data and performs the required control, a display preparation image data memory unit (4) in which image data of the page being displayed and the page to be displayed next are stored, and a display unit (5) on which information concerning the image data and information concerning the operation of the electronic book are displayed. The data displayed on the display unit at a specific time in a page turning period are stored in a page turning data memory unit (9) and the column information of the page turning data is stored in a column information storage table (10). In accordance with the column information, the address of the display preparation image data memory unit (4) and the image data on the page being displayed and the page to be displayed next are selected by a display changeover control unit (11).

**DECLARATION AND POWER OF ATTORNEY**

As a below named inventor, I hereby declare that: My residence, post office address and citizenship are as stated below next to my name. I believe I am the original, first and sole inventor (if only one name is listed at 201) below or an original, first and joint inventor (if plural names are listed at 201-208 below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**DISPLAY CONTROL DEVICE AND REPRODUCTION DISPLAY DEVICE FOR  
ELECTRONIC BOOKS**

which is described and claimed in:

- ☐ the specification attached hereto.
- ☐ the specification in U.S. Application Serial Number \_\_\_\_\_,  
filed on \_\_\_\_\_.
- ☒ the specification in PCT international application Number PCT/JP98/04324,  
filed on September 25, 1998; and was amended on \_\_\_\_\_.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a). I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

No. filed on

Prior Foreign/PCT Applications and Any Priority Claims Under 35 U.S.C. §119:			
Application No.	Filing Date	Country	Priority Claimed Under 35 U.S.C. §119?
9-296601	29th, October 1997	JAPAN	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
10-85405	31th, March 1998	JAPAN	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below, and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose material information as defined in 37 CFR §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:



**Prior U.S. Applications or PCT International Applications Designating the U.S-Benefit  
Under 35 U.S.C. §120**

U.S. Applications		Status (Check One)		
Application Serial No.	U.S. Filing Date	Patented	Pending	Abandoned
PCT Applications Designating the U.S.				
Application No.	Filing Date	U.S. Serial No. Assigned		

**CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)  
(35 U.S.C. §119(e))**

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below:

Applicant	Provisional Application Number	Filing Date

**POWER OF ATTORNEY:** As a named inventor, I hereby appoint the following attorney(s) with full powers of association, substitution and revocation to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

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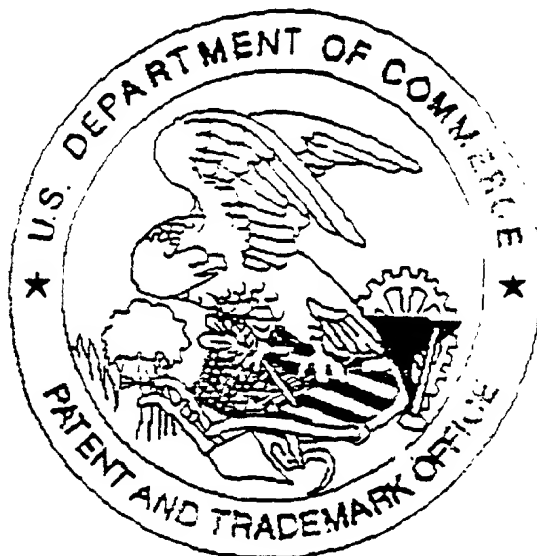
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I hereby further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Date: <i>March</i> <i>May 24, 2000</i> <i>Y.S. 2000/2/30</i>	Date: <i>Mar 28, 2000</i>
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Date: <i>March 30, 2000</i>	Date: <i>Mar 30, 2000</i>

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